Product Description Document
U.S.-Canada 1D Geoelectric Field Model
April 2023

Part 1 – Mission Connection

a) Product Description:

The US-Canada 1D Geoelectric Field Model uses 1D conductivity models over the lower 48 United States and over Canada up to 60 degrees latitude, with output spatial resolution of 1/2 degree in latitude and longitude, and is an upgrade to the current Regional Geoelectric 1D Model. The geoelectric field is a measure of the induction hazard to man-made conductors, such as electrical power lines, that results from geomagnetic activity, and can be used to estimate the amount of current induced by integrating along the conducting pathway.

b) Purpose/Intended Use:

The upgraded product expands coverage into Canada. In addition, the spatial resolution is improved to ½ degree latitude and longitude over CONUS and Canada. Potentially hazardous geoelectric fields can be induced during geomagnetic storms. These geomagnetic storms are a form of space weather driven by enhanced currents in Earth's magnetosphere and ionosphere and are observed at ground level as a time-varying magnetic field which induces currents along natural and artificial conducting pathways. This geoelectric field product combines information about the time-varying magnetic field together with Earth-conductivity information to estimate regional geoelectric fields.

c) Audience/Users:

The electrical power industry is expected to be the primary user of this upgraded product. The amount of current induced in an artificial conductor may be calculated by integrating the geoelectric field along the conducting pathway. When currents are induced in artificial conductors, unexpected and sometimes problematic effects can occur in the operation of the affected equipment.

d) Presentation Format:

The product results consist of a web page with an updating geoelectric field map, and a data service with the gridded model output in geojson format. PNG maps, an image animation tool, and geojson files are available for quantitative applications. The product is an experimental, joint U.S.-Canada geoelectric field web page with a map that updates in near real time. The service also includes numerical gridded output files in geojson format.

e) Feedback Method:
The NWS is accepting comments through May 3, 2023, via email to the following contacts:

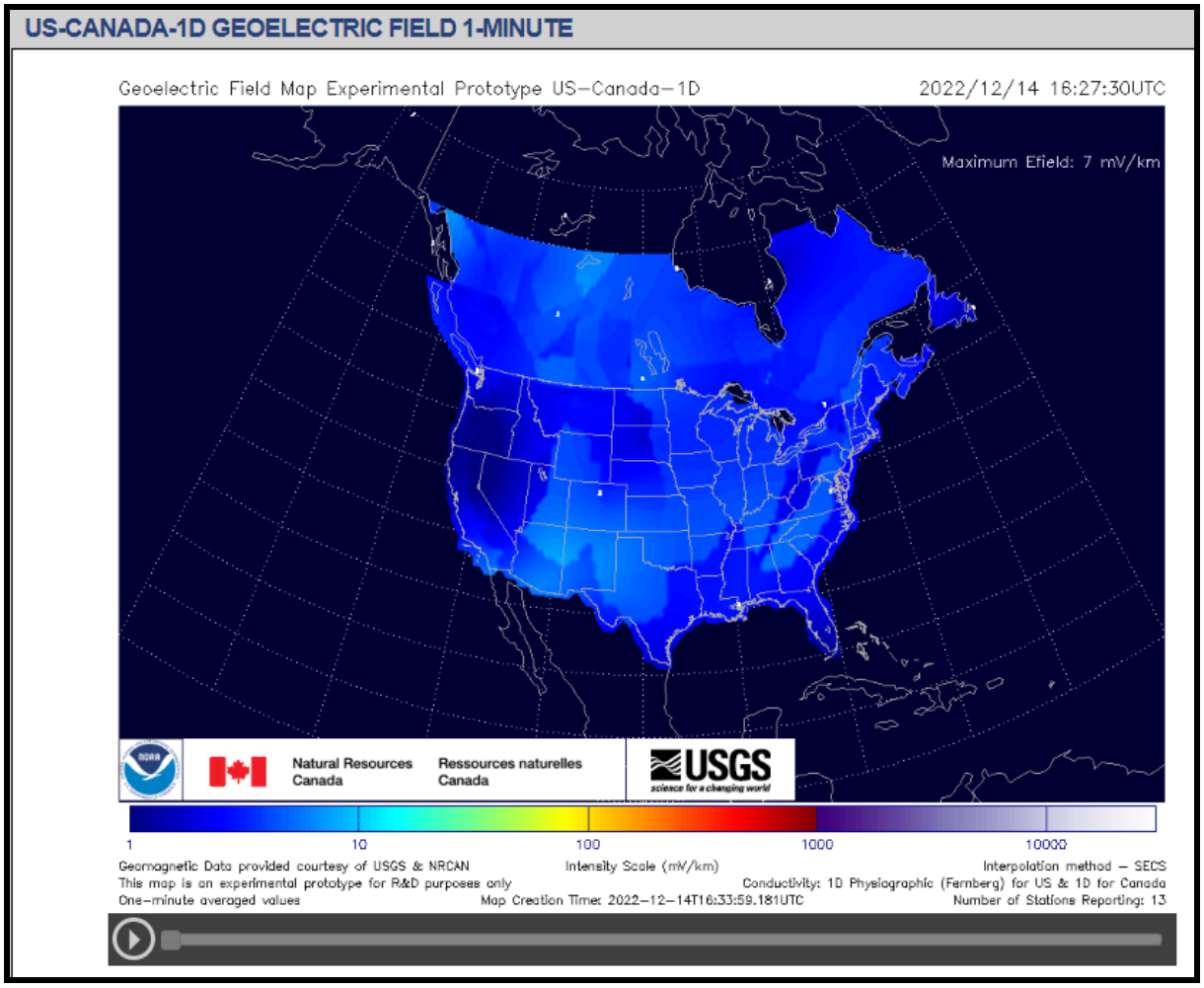
Steven Hill
Geoelectric Project Lead
NOAA Space Weather Prediction Center
Boulder, CO
Email: steven.hill@noaa.gov

and

Dr. Jennifer L. Meehan
National Space Weather Program Manager
National Weather Service Headquarters
Silver Spring, MD
Email: jennifer.meehan@noaa.gov

Part 2 – Technical Description

a) Format:
In the US-Canada-1D version, geomagnetic time-series are interpolated onto a 0.5 degree by 0.5 degree grid using the method of Spherical Elementary Current Systems (SECS). The Earth conductivity is determined based on the physiographic region in which the grid point lies and the associated one-dimensional conductivity profile. A sample portion of the product/service:



For a complete example, see a real-time product at:
https://www.swpc.noaa.gov/products/experimental/us-canada-1d-geoelectric-field-1-minute

b) Availability:
https://www.swpc.noaa.gov/products/experimental/us-canada-1d-geoelectric-field-1-minute

https://services.swpc.noaa.gov/experimental/json/lists/rgeojson/US-Canada-1D/

Web browsers will be able to display the web page and the geojson files. Many downstream user applications are able to incorporate geojson format files for deeper analysis or layering the information in various mapping tools.